(12) UK Patent Application (19) GB (11) 2 074 124 A

(21) Application No 8001362
(22) Date of filing 15 Jan 1980
(43) Application published
28 Oct 1981
(51) INT CL³
B65D 25/54 B31C 1/06
(52) Domestic classification
B8D 15 1A3 1A4B2 1B1
7C CW10
B5D B6
B8P Q
(56) Documents cited
GB 1221674
GB 1038999
GB 628184
GB 457684
GB 445043
GB 413956
GB 321176
GB 308109
(58) Field of search
B8D
B8P
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(54) **Paper tube containers**

(57) A paper tube container (Fig. 1 not shown) has a window or aperture in its side wall which is of double convolute wound construction formed by winding an apertured blank. A paperboard bottom is secured in position by having a peripheral flange around which is folded a bottom end flange of the side wall. The window or aperture in the side wall provides a zone of axial weakness that is a source of potential buckling under the axial stresses imparted on the side wall during the folding of its bottom end flange by a folding tool 31 and such buckling is resisted by inserting a expansible mandrel 30 into the tubular blank before the folding and increasing the effective diameter of the mandrel to hold the tubular blank from within.

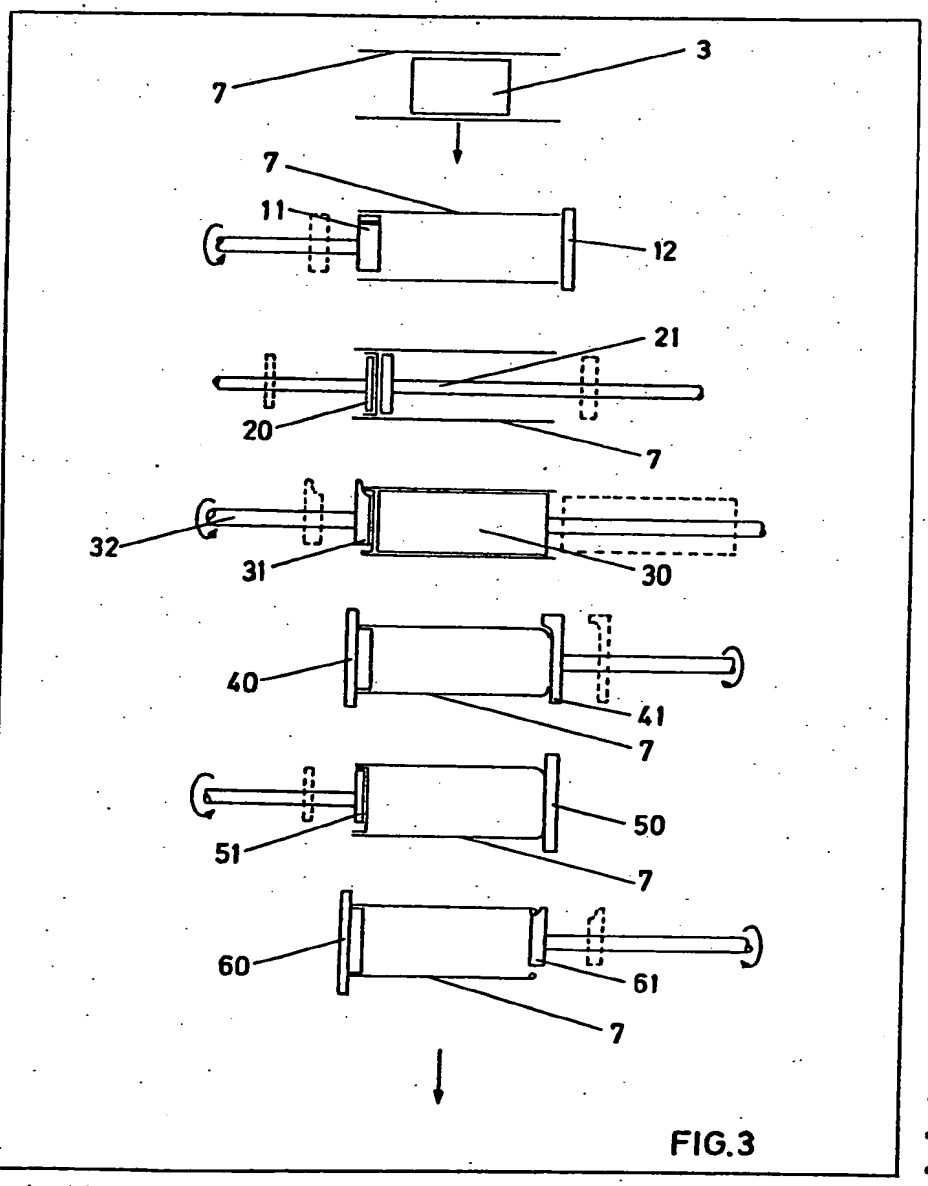


FIG.3

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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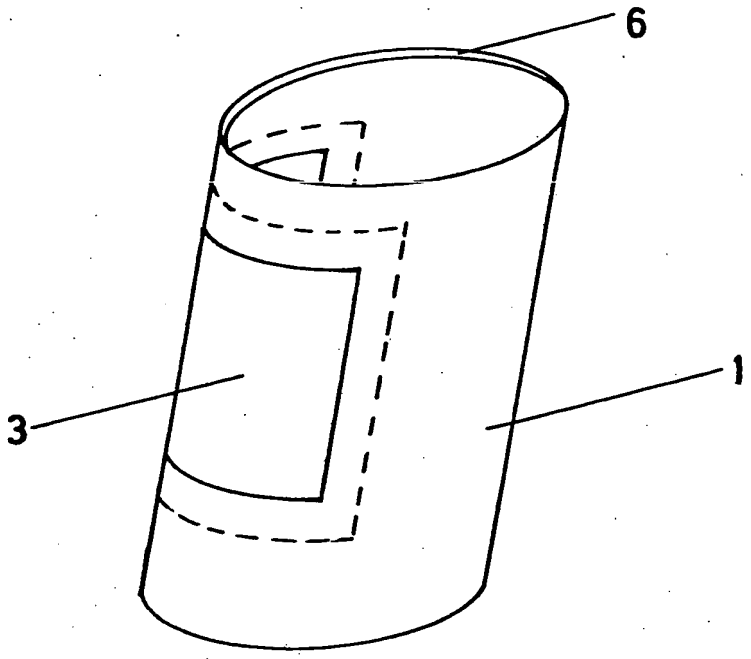


FIG.1

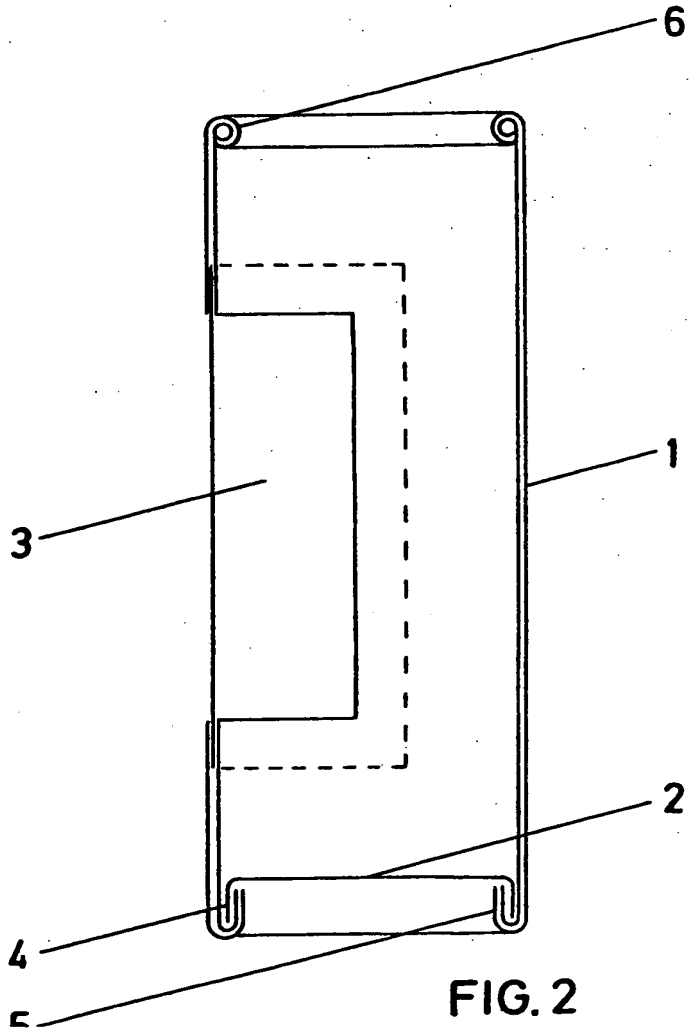


FIG. 2

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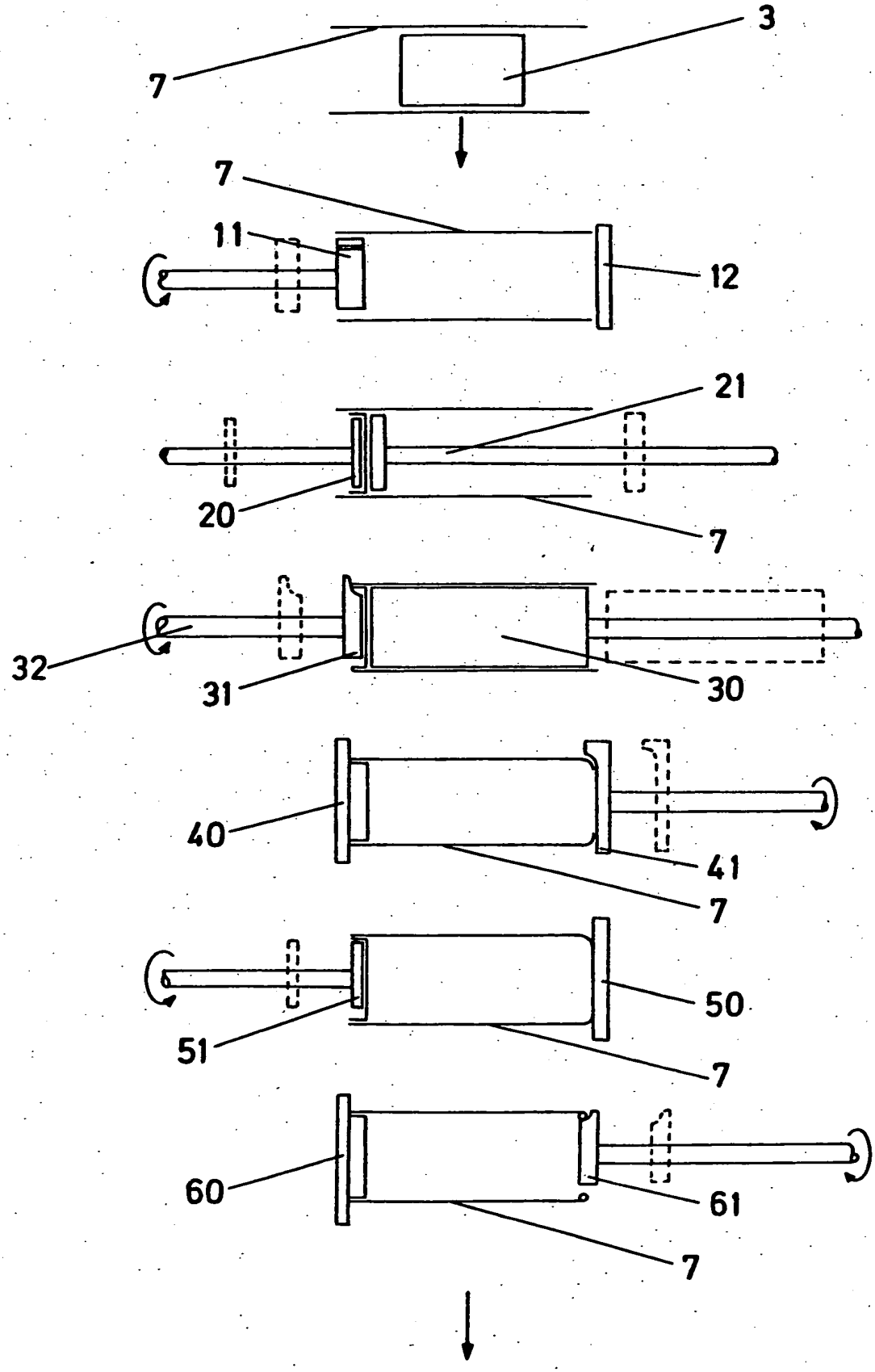


FIG.3

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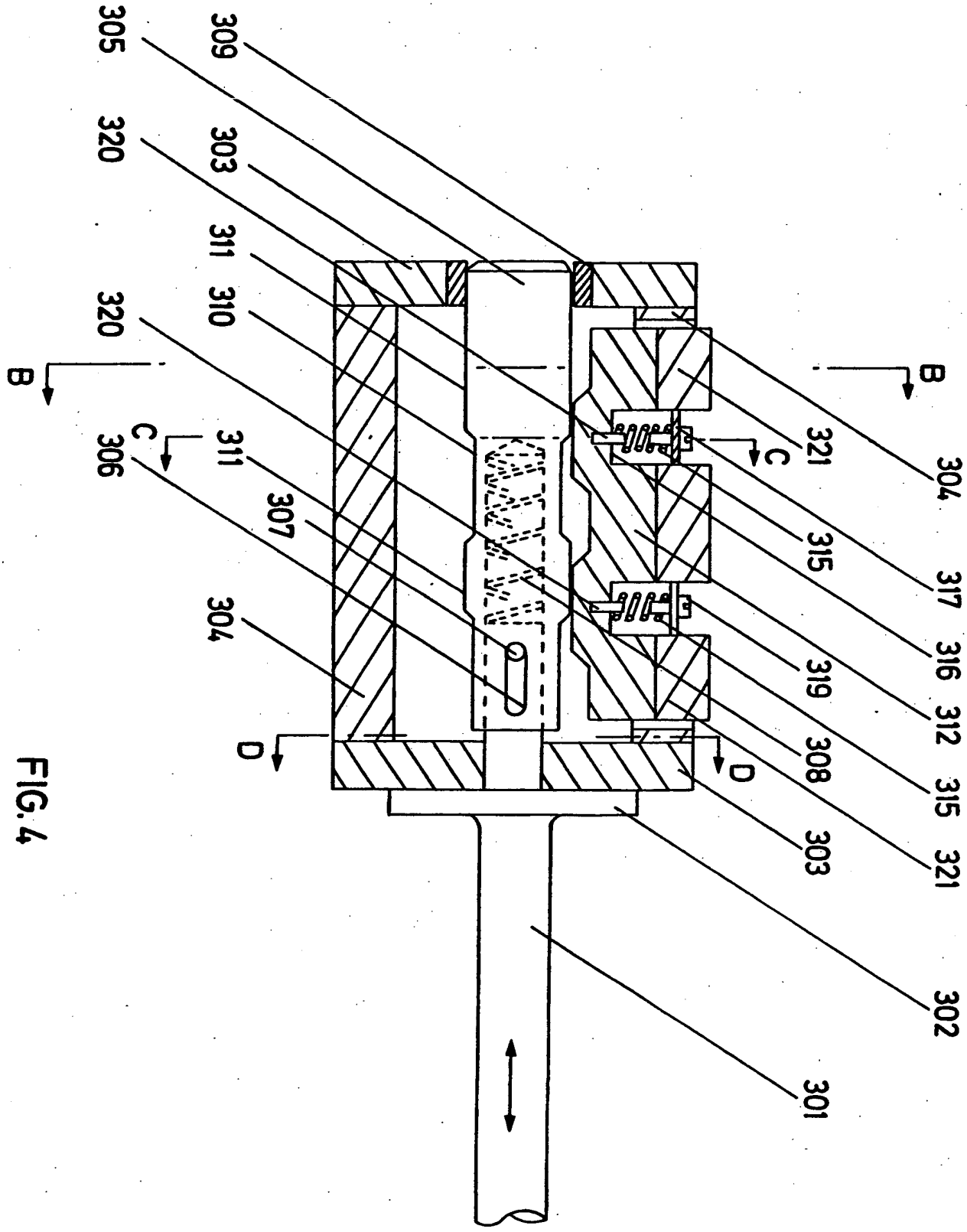



FIG. 4

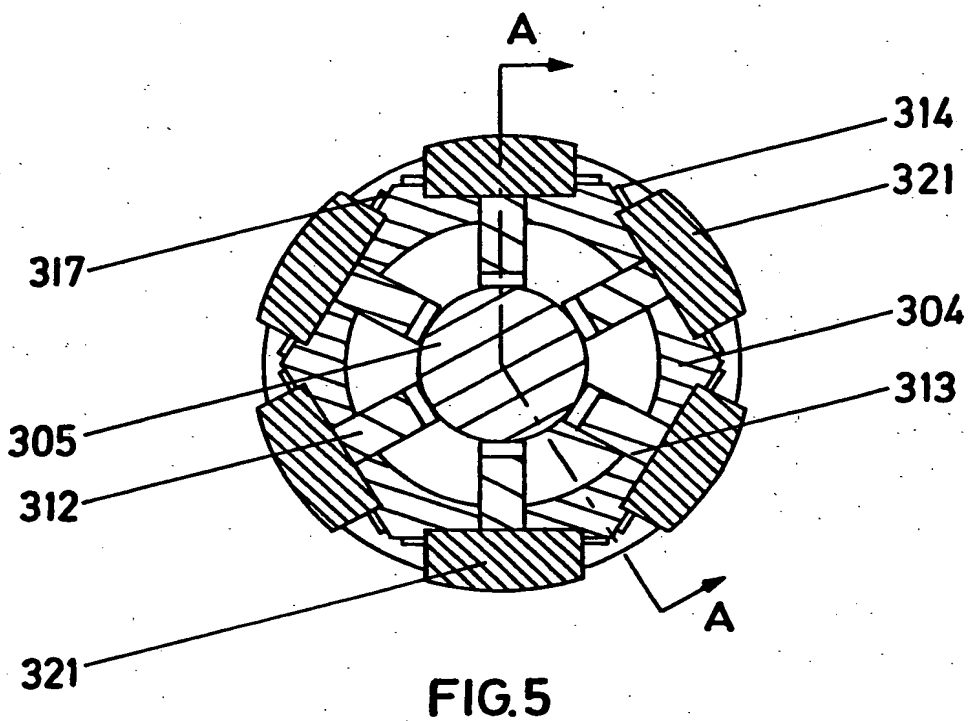
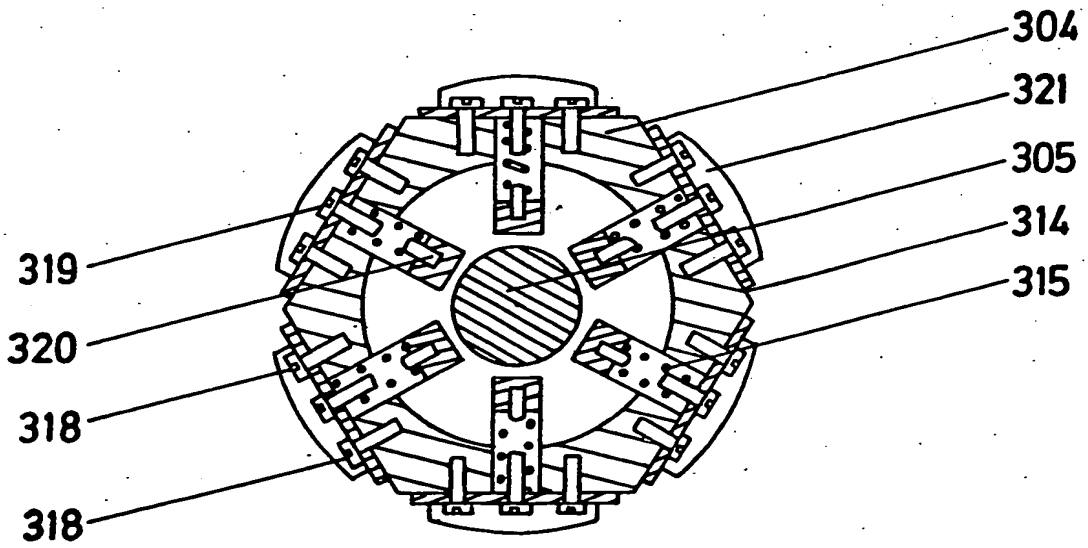

A
314
321
317
304
313
305
312
A
321

FIG.5


304
321
305
314
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318
318

FIG. 6

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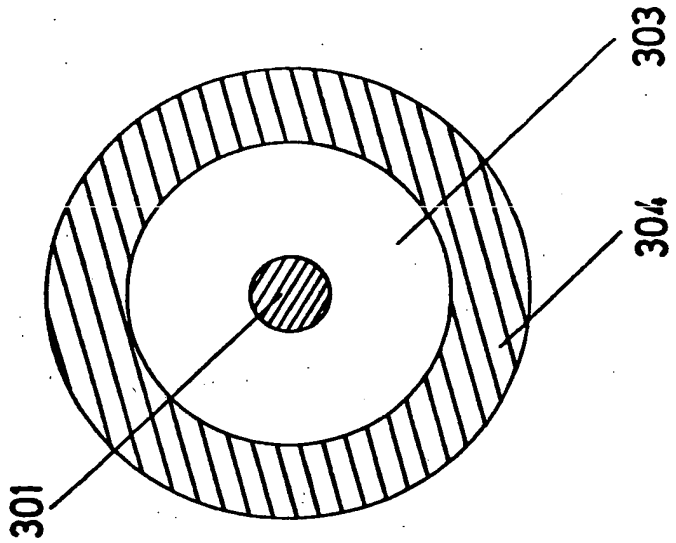


FIG.7

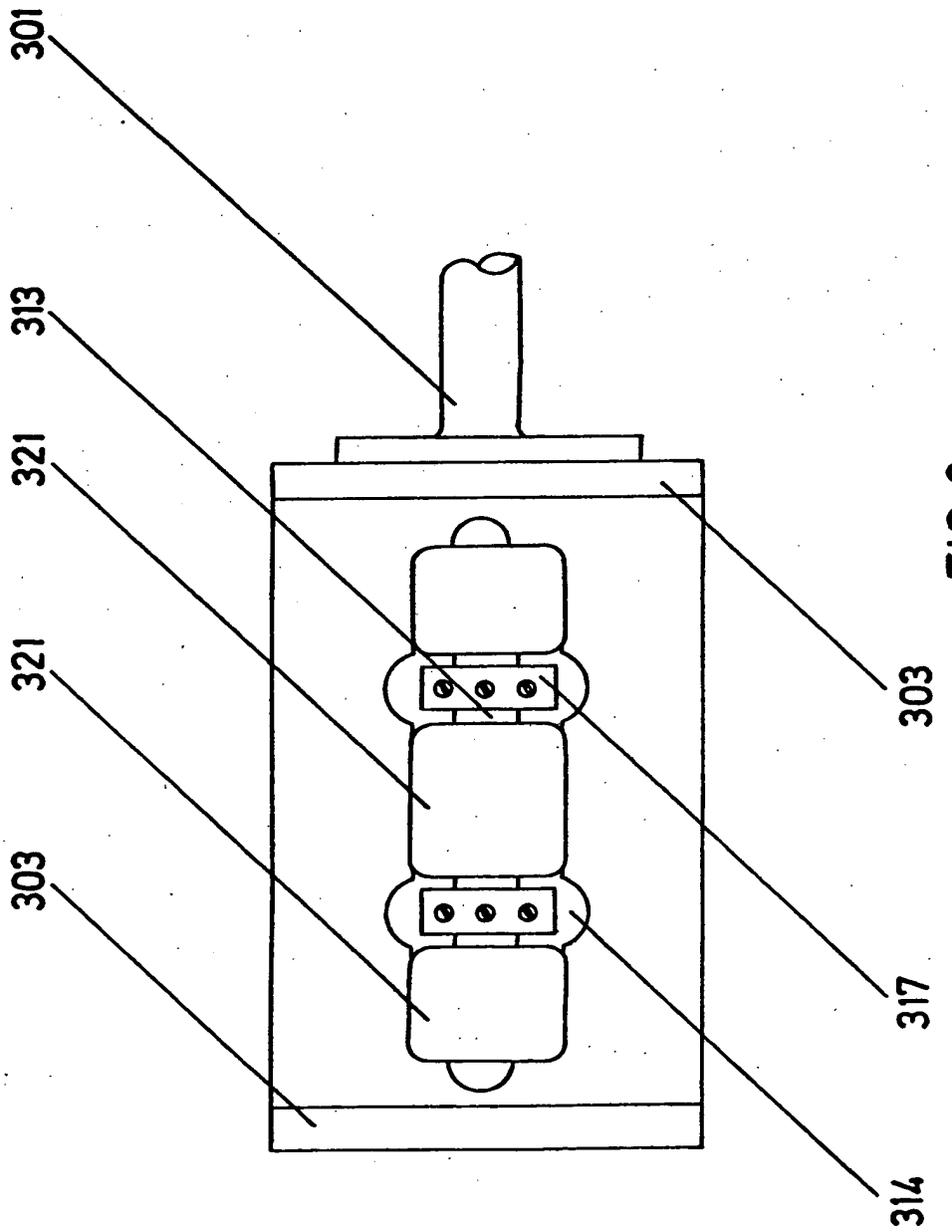


FIG.8

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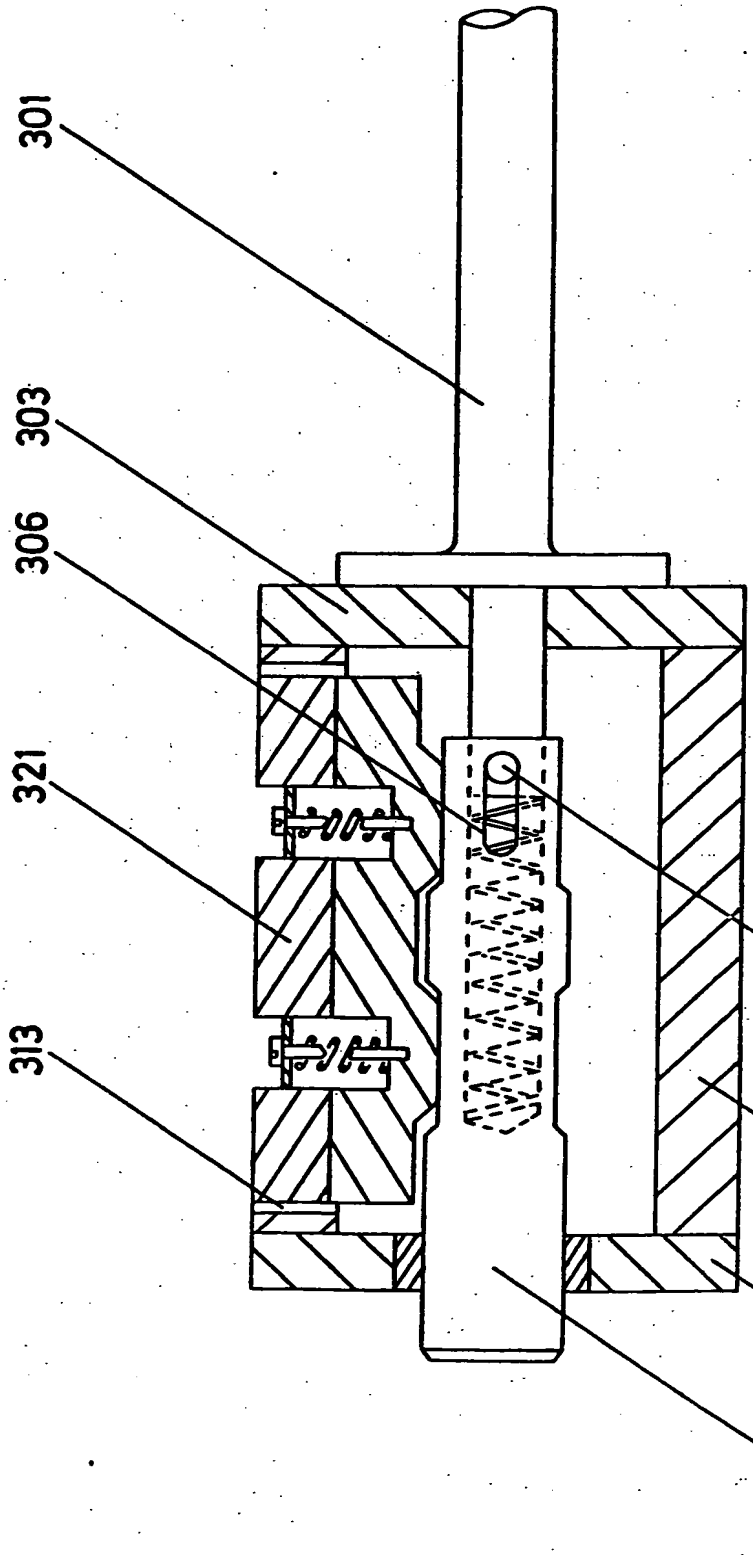


FIG.9

SPECIFICATION

# Paper tube containers, and method and machine for making them

The invention relates to paper tube containers of double convolute wound construction and having a cylindrical side wall, and to a method and machine for making them. These containers are, in general, well known and are produced on machines similar to those used to produce paper cups for automatic drink vending machines. Such machines comprise means for winding the double convolute side wall of the container, this being a conical side wall in the case of drink cups or a cylindrical side wall in the case of cylindrical paper tube containers. The side wall is referred to as the tubular blank, and is formed by winding paperboard around a mandrel for two complete revolutions, 720°, and adhering the two plies together. This provides the double convolute wound construction.

To insert the bottom into the container being formed, adhesive is applied to a first end portion of the tubular blank and a paperboard bottom with a peripheral flange is pushed into that end portion. The paperboard bottom is then held from the other end of the tubular blank by a mandrel while the first end portion of the blank, or side wall, is folded around the peripheral flange of the bottom where it is retained by the adhesive.

The folding of the first end portion of the tubular blank around the flange of the bottom imparts quite considerable axial stress on the blank, and it has always been necessary to have the blank sufficiently robust to withstand this axial stress. The folding is effected by means of a heated folding head the action of which is to bend over the end portion of the tubular blank at a single angular position and to precess that zone of folding around the blank until the bottom end of the blank is folded inwardly on itself through 180° around the peripheral flange of the paperboard bottom. Thus the axial stress on the blank is not constant during the folding by precesses rapidly around the blank in a manner which is very liable to cause buckling of the blank.

The invention provides a paper tube container having a double convolute wound cylindrical side wall in which is formed at least one window or aperture, and a paperboard bottom provided with a peripheral flange around which is folded a bottom end flange of the side wall.

It has not previously been possible to produce such a paper tube container, as to attempt to do so on conventional machinery would cause buckling of the tubular blank as discussed above, due to the zones of axial weakness around the blank provided by the one or more windows or apertures. The invention also provides a method and machine for manufacturing such containers.

The method of the invention comprises winding a double convolute paper cylindrical tubular blank from paper having apertures therein spaced and sized such that in the tubular blank the apertures are in alignment with one another; inserting a flanged bottom at a first end portion of the blank; inserting a mandrel into the blank from the other end thereof; increasing the effective diameter of the mandrel to hold the tubular blank from within while the first end portion of the tubular blank is folded around the flange of the bottom; and contracting the mandrel diameter for removal of the mandrel from the blank. Expansion of the mandrel to increase its effective diameter may be achieved by providing the mandrel with a number of segments around its periphery, each segment being moved radially outwardly to increase the effective mandrel diameter to hold the tubular blank from within during folding of the first end portion of the blank around the flange of the bottom. For example the segments may be moved radially outwardly by the cam action of a plunger movable axially of the mandrel and acting on all the segments together for example when the mandrel is brought into its working relationship with the folding head.

The machine of the invention comprises:

means for winding a cylindrical paper tube blank in the wall of which is formed at least one window or aperture;

means for forming a flanged paper bottom for the blank;

a first work station provided with means for applying adhesive to the inside of the blank at a first end portion thereof;

a second work station provided with means for inserting the flanged paper bottom into the blank at the first end portion thereof; and

a third work station provided with a mandrel for holding the blank and a folding head for folding the first end portion of the blank around the flange of the paper bottom, the mandrel having means for increasing its effective diameter to hold the blank from within during operation of the folding head and means for contracting its effective diameter for removal of the mandrel from the blank.

Further work stations may be included as desired, for example:

a fourth work station provided with means for half-turning a brim roll at the other end portion of the blank;

a fifth work station provided with means for crimping the flange formed at the third work station by the folding head; and

a sixth work station provided with means for completing the turning of the brim roll.

Using the method and machine of the invention, the tubular blank is supported from within during the folding operation, in a manner not previously considered. The support is sufficient to prevent the blank from creasing or buckling during the folding operation, and the contraction and expansion of the mandrel to change its effective diameter enables this close support to be provided even on high speed machines on which a conventional mandrel, manufactured to a close tolerance to fit the inside of the tubular blank, would give rise to numerous problems due to friction.

Paper tube containers according to the invention are a valuable adjunct to the range of packaging materials currently available. One particularly desirable form of the container has a window of a transparent or translucent film spanning aligned apertures in the two plies of the convolute wound side wall and anchored between the plies. Such a container is attractive to look at, enables the products within the container to be displayed, and does not present raw edges of the window film material on the inside of the container to snag or otherwise interfere with the contents of the container.

Drawings

Figure 1 is a perspective view of a paper tube container according to the invention;

Figure 2 is a schematic axial section through the container of Figure 1;

Figure 3 is a schematic plan view of a machine for assembling the container of Figure 1 from a tubular blank and a paperboard bottom;

Figure 4 is a staggered axial section through a mandrel for use at work station *c* of Figure 3, the section being along the line A—A of Figure 5;

Figures 5, 6 and 7 are sections taken along the lines B—B, C—C and D—D respectively of Figure 4;

Figure 8 is a plan view of the mandrel in the direction of the arrow E of Figure 4; and

Figure 9 is a section corresponding to that of Figure 4 but showing the mandrel in its condition of decreased effective diameter for easy insertion and removal.

Referring first to Figures 1 and 2, the paper tube container comprises a cylindrical wall 1 and a base 2. The wall is of two-ply construction, and is produced initially as a completely cylindrical tubular blank by winding two complete turns or convolutions of paperboard around a cylindrical mandrel. Two apertures in the paperboard are accurately sized and positioned so that when the paperboard is wound around the mandrel the apertures lie exactly one over the other. If desired the aperture arranged to lie on the inside of the convolute two-ply tubular blank may be marginally larger than that which is to lie on the outside, so that any minor inaccuracies in alignment are not apparent from the outside. Before winding the paperboard onto the mandrel, a window of transparent plastics film, such as a vinyl acetate film or one sold under the Trade Mark MELINEX, is preferably adhered to the paperboard spanning one of the apertures so that in the tubular blank the film forms a window 3 across the aligned apertures and sandwiched between the plies of the tube as shown in the slightly exploded schematic section of Figure 2.

At the bottom end of the cylindrical wall 1, the end portion 4 of the wall is turned upwardly and inwardly through 180° to form a flange around a downturned peripheral flange portion 5 of the base 2, the interfolded flanges 5 and 4 being secured together by adhesive.

At the top end of the cylindrical wall 1, the wall is turned inwardly into a brim roll 6.

The container of Figures 1 and 2 can be used to package and display a variety of dry goods. A closure member may be provided to close the container at the top around the brim roll 6.

Figure 3 illustrates in general terms how the container of Figures 1 and 2 may be manufactured. A supply of tubular blanks 7 is provided at F, the blanks 7 being advanced past a row of workstations *a* to *f* as shown.

Each tubular blank 7 has been formed by double winding a paperboard blank around a mandrel (not shown) to bring pairs of apertures 3 in the blank into alignment as previously described.

A supply of paper bottoms 2 is provided at G, each paper bottom being already provided with its peripheral flange 5 as shown.

At each workstation, machine elements act upon the tubular blank from right and left hand ends thereof as indicated "L" and "R" in the drawing.

At the first workstation, *a*, at the left there is a glue spreader 11 and at the right there is a stop 12 for the tubular blank 7. The glue spreader 11 indexes in to a position within the blank 7 and adjacent an end portion thereof and, rotating, spreads a film of adhesive over that end portion of the blank on its inner wall. A suitable adhesive is polyvinyl acetate. The glue spreader 11 then returns to its rest position (shown in broken lines) while the blank 7 is indexed along to a second workstation, *b*.

At the second workstation, *b*, at the left there is a reciprocating plunger 20 for carrying individual paper bottoms 2 from the supply F (located in practice immediately above the left hand limit of the plunger's stroke) to the glued end portion of the tubular blank 7. At the right is a cooperating plunger 21 which passes into the tubular blank 7 and provides a stop for the paper bottom 2 being inserted. The return positions of the plungers are shown in broken lines.

At the third workstation, *c*, a mandrel 30 enters the blank 7 from the right and then increases its effective diameter (as described below) to grip the internal surface of the blank while a heated folding head 31 is advanced from the left, engages the left-hand end of the blank 7 and folds that end inwardly through 180° as a flange 4 around the flange 5 of the paper bottom 2. The folding head 31 is mounted eccentrically of its shaft 32 so that it acts on only one zone on the periphery of the blank 7 at any one time, but precesses around the periphery until folding is complete. This imparts considerable axial stress on the tubular blank 7, but the internal support provided by the mandrel 30 is sufficient to resist buckling. The return positions of the mandrel 30 and folding head 31 are shown in broken lines, from which it will be seen that the effective diameter of the mandrel 30 has decreased to enable it to be withdrawn freely from the tubular blank.

At the fourth workstation, *d*, there is shown, on the left, a stop 40 and on the right a first beading

head 41. The head 41 is a rotating heated eccentric head effective to half turn a head on the right hand end of the blank 7.

At the fifth workstation *e* is, on the right, a stop 50 and on the left a rotating crimping head 51. This is a heated head which crimps together the flanges 4 and 5.

At the sixth and final workstation *f* is, on the left, a stop 60 and on the right a second beading head 61 which is similar to the first beading head 41 but shaped to complete the brim roll of the container.

Figures 4 to 9 show a preferred construction of the mandrel 30. The mandrel is mounted on a shaft 301 which can be advanced and retracted in the direction of the double-headed arrow. Mounted securely on a collar 303 of the shaft 301 is the mandrel assembly comprising a pair of end discs 303 secured to and separated by a spacer cylinder 304. The discs 303 and cylinder 304 have the same external diameter, which is slightly less than that of the tubular blank 7.

A plunger 305 is mounted coaxially on the shaft 301 at the left hand end thereof and is capable of a limited amount of axial movement relative to the shaft, the limits being set by a keyway 306 in the plunger in which a grubscrew 307 on the shaft 301 is slidable. A spring 308 urges the plunger 305 to the left as viewed in Figure 4 (towards the position shown in Figure 9), with a collar 309 supporting the plunger for free sliding movement as it passes through the left hand end disc 303. The plunger 305 is made of phosphor-bronze and has a pair of waisted portions 310 and a pair of larger diameter portions 311 as shown, and cooperates with an annular array of cams 312 as described below.

Along the outer surface of the spacer cylinder 304 there are milled six equally spaced longitudinal grooves 313 (Figure 5) each of which extends completely through the wall of the spacer cylinder for substantially the whole of the cylinder length. Transverse to each of the grooves 313 are two milled flats 314.

Each of the longitudinal grooves 313 houses a cam 312 which is made of a thermoplastic resin such as a polyamide and is freely movable in the radial direction. The cams 312 are inserted radially and retained in position by springs 315 compressed between recessed outer portions 316 of the cams 312 and steel retainer plates 317 bolted to the flats 314 by screws 318 and spanning the grooves 313. Screws 319 and 320 act as spring retainers.

Bolted to each of the cams 312 are three face pieces 321 which are made from thermoplastic resin such as polyamide and have arcuate outer faces. When the cams 312 are extended radially outwards as in Figure 4 these face pieces 321 increase the effective diameter of the mandrel 30 to one which effectively and firmly grips the interior of the tubular blank 7. When the cams 312 are retracted by the springs 315 as in Figure 9 the effective diameter of the mandrel 30 is contracted, enabling the assembly to be freely inserted into or removed from the tubular blank 7. In use this increase and decrease of the effective diameter of the mandrel 30 is automatically controlled by the plunger 305. When the mandrel 30 is in its return position, as shown in broken lines in Figure 3, the spring 308 urges the plunger to the left as shown in Figure 9 and the effective diameter is decreased. When the mandrel 30 is in its working position the plunger 305 abuts the folding head 31, through the paper bottom 2, and is thus urged against the bias of the spring 308 to the position shown in Figure 4. The control of the effective mandrel diameter is thus simply and accurately achieved and is always in synchronization with the speed of the remainder of the machine.

## CLAIMS

1. A paper tube container having a double convolute wound cylindrical side wall in which is formed at least one window or aperture, and a paperboard bottom provided with a peripheral flange around which is folded a bottom end flange of the side wall.

2. A paper tube container according to claim 1, wherein the window is a transparent or translucent film spanning aligned apertures in the two plies of the convolute wound side wall and anchored between the plies.

3. A paper tube container according to either preceding claim, wherein the top end of the side wall is beaded into a brim roll.

4. A method of assembling a paper tube container, comprising winding a double convolute paper cylindrical tubular blank from paper having apertures therein spaced and sized such that in the tubular blank the apertures are in alignment with one another; inserting a flanged bottom at a first end portion of the blank; inserting a mandrel into the blank from the other end thereof; increasing the effective diameter of the mandrel to hold the tubular blank from within while the first end portion of the tubular blank is folded around the flange of the bottom; and contracting the mandrel diameter for removal of the mandrel from the blank.

5. A method according to claim 4, wherein the mandrel is provided with a number of segments around its periphery, each segment being moved radially outwardly to increase the effective mandrel diameter to hold the tubular blank from within during folding of the first end portion of the blank around the flange of the bottom.

6. A method according to claim 5, wherein the radial outward movement of the segments is achieved by the cam action of a plunger movable axially of the mandrel and acting on all the segments together.

7. A method according to claim 6, wherein the plunger is spring-biased to be projected from an end of the mandrel so that engagement of the mandrel and a folding head, effective to fold the first end portion of the tubular blank around the flange of the bottom, causes axial movement of

the plunger and a resulting increase in the effective mandrel diameter.

8. A machine for producing cylindrical paper tube containers having double convolute wound cylindrical side walls in which are formed at least one window or aperture, comprising:

means for winding a cylindrical paper tube blank in the wall of which is formed at least one window or aperture;

means for forming a flanged paper bottom for the blank;

a first work station provided with means for applying adhesive to the inside of the blank at a first end portion thereof;

a second work station provided with means for inserting the flanged paper bottom into the blank at the first end portion thereof; and

a third work station provided with a mandrel for holding the blank and a folding head for folding the first end portion of the blank around the flange of the paper bottom, the mandrel having means for increasing its effective diameter to hold the blank from within during operation of the folding head and means for contracting its effective diameter for removal of the mandrel from the blank.

9. A machine according to claim 8, further comprising:

a fourth work station provided with means for half-turning a brim roll at the other end portion of the blank;

a fifth work station provided with means for crimping the flange formed at the third work station by the folding head, and heat-setting the adhesive; and

a sixth work station provided with means for completing the turning of the brim roll.

10. A machine according to claim 8 or claim 9, wherein the mandrel at the third work station is provided with a number of segments around its periphery, each segment being moved radially outwardly to increase the effective mandrel diameter to hold the tubular blank from within during folding of the first end portion of the blank around the flange of the bottom.

11. A machine according to claim 10, wherein the radial outward movement of the segments is achieved by the cam action of a plunger movable axially of the mandrel and acting on all the segments together.

12. A machine according to claim 11, wherein the plunger is spring-biased to project from an end of the mandrel so that engagement of the mandrel and the folding head causes axial movement of the plunger relative to the mandrel and a resulting increase in the effective mandrel diameter.

13. A machine according to any of claims 8 to 12, wherein the means for winding the blank is effective to produce a blank having a window of transparent or translucent film spanning aligned apertures in the two plies of the paper blank and sandwiched between those plies.

14. A paper tube container substantially as described herein with reference to the drawings.

15. A method of assembling a paper tube container substantially as described herein with reference to the drawings.

16. A machine for producing a paper tube container, substantially as described herein with reference to the drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1981. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.